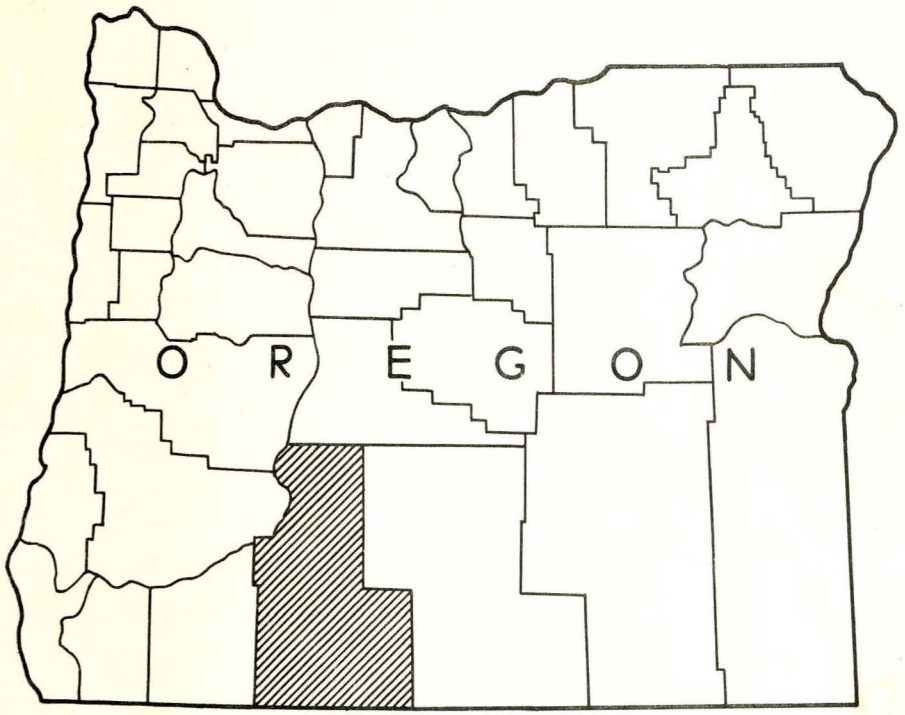
FOREST STATISTICS
FOR
KLAMATH COUNTY, OREGON

FROM THE FOREST SURVEY INVENTORY REVISED IN 1946

FOREST SURVEY REPORT NO. 99



U.S. DEPARTMENT OF AGRICULTURE — FOREST SERVICE
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
J.A. HALL, DIRECTOR

DIVISION OF FOREST ECONOMICS
PORTLAND, OREGON
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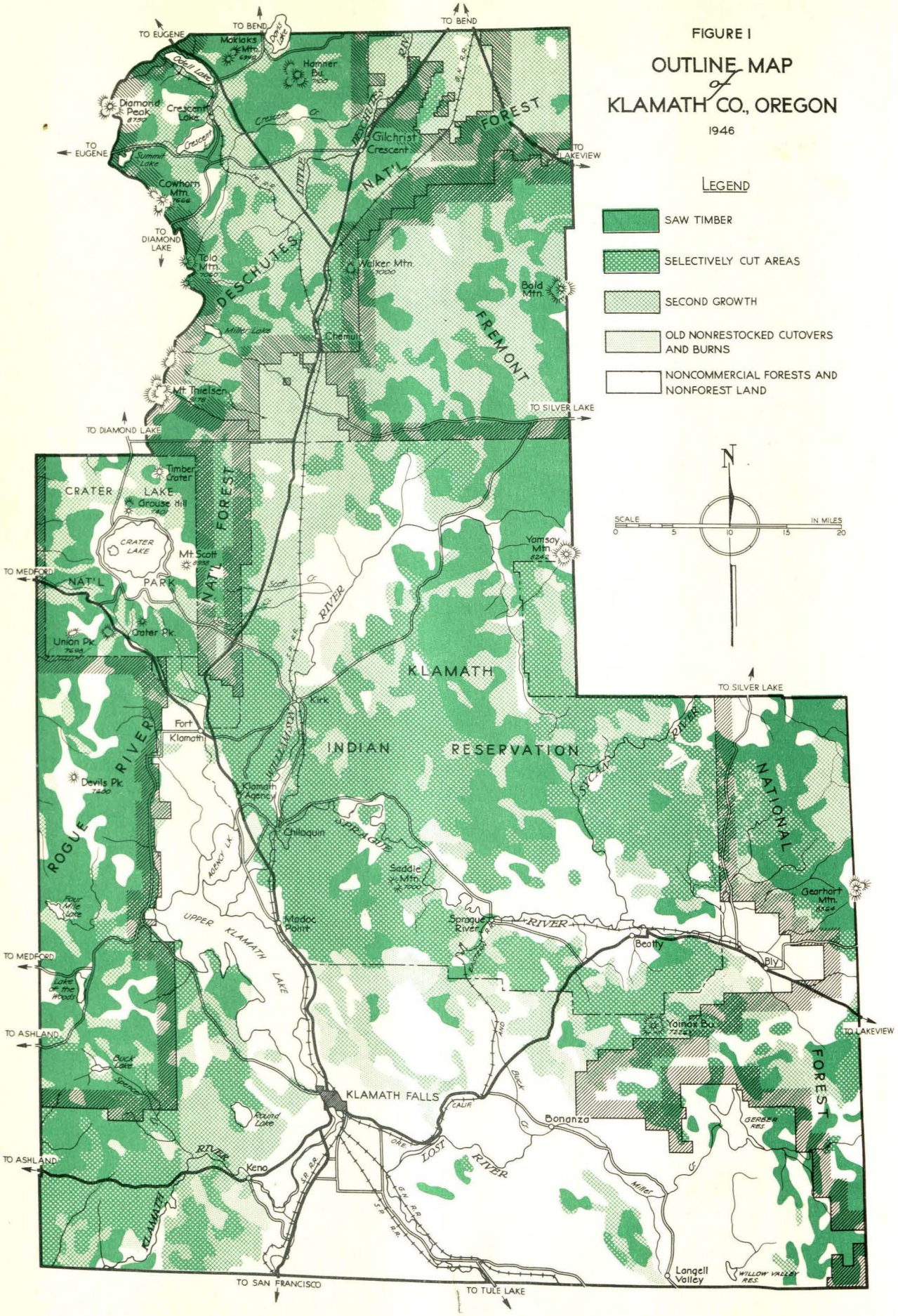
FIGURE I
OUTLINE MAP of KLAMATH CO., OREGON
1946
LEGEND
SAW TIMBER
SELECTIVELY CUT AREAS
SECOND GROWTH
OLD NONRESTOCKED CUTOVERS AND BURNS
NONCOMMERCIAL FORESTS AND NONFOREST LAND
N
SCALE
0
5
10
15
20
IN MILES
TO BEND
TO EUGENE
TO LAKEVIEW
TO DIAMOND LAKE
TO SILVER LAKE
TO MEDFORD
TO ASHLAND
TO SAN FRANCISCO
TO TULE LAKE
DESCHUTES NAT'L FOREST
FREMONT NAT'L FOREST
CRATER LAKE NAT'L PARK
KLAMATH INDIAN RESERVATION
KLAMATH FALLS
Maklaks Mtn.
Hamner Bu.
Diamond Peak
Crescent Lake
Gilchrist
Cowhorn Mtn.
Talo Mtn.
Walker Mtn.
Bald Mtn.
Chemult
Mt. Thielsen
Timber Crater
Grouse Hill
Mt. Scott
Union Pk.
Crater Pk.
Yamsay Mtn.
Fort Klamath
Kirk
Devils Pk.
Klamath Agency
Chiloquin
Saddle Mtn.
Modoc Point
Sprague River
Beatty
Bly
Gearhart Mtn.
Yainax Bu.
Four Mile Lake
Lake of the Woods
Buck Lake
Round Lake
Keno
Bonanza
Langell Valley
Willow Valley Res.
Gerber Res.
Rogue River
Williamson River
Sprague River
Sycan River
Lost River
Klamath River
Upper Klamath Lake
Crescent Lk.
Odell Lake
Summit Lake
Miller Lake
Scott Cr.
Crescent Cr.
Buck Cr.
Miller Cr.
Spencer Cr.
Deschutes River
Little Deschutes River
S.P. R.R.
G.N. R.R.
O.&C. R.R.
Calif. & Ore. Line

FOREWORD

The forest survey, a Nation-wide project, consists of a detailed investigation in five major parts of present and future forest resources: (1) An inventory of the country's existing forest resources in terms of area occupied by forest-cover types and of timber volumes, by species, in board feet and cubic feet, and a study of conditions on cut-over and on burned forest lands; (2) a study of the drain on forests through cutting and through loss from fire, insects, disease, and other causes; (3) a determination of the current and potential growth on forest areas; (4) an investigation of present and prospective requirements for forest products; and (5) an analysis and correlation with other economic data of findings of these studies in order to make available basic facts and guiding principles necessary to plan for sound management and use of forest resources.

The forest survey of Oregon and Washington, an activity of the Pacific Northwest Forest and Range Experiment Station, was conducted in the ponderosa pine region during the period 1934-37.[1/] In 1937 work of keeping the survey up to date was commenced in the Douglas-fir subregion and in 1945 was extended to the ponderosa pine subregion. Counties in which there has been a large amount of cutting depletion since the original surveys are given first priority in the resurvey.

The original forest inventory for Klamath County, Oregon, was conducted in 1934, and a statistical report and a detailed forest type map were issued as of February 1, 1936. Field work for the re-inventory of the county's forests was carried on during 1945 and part of 1946. Adjustments were made for changes resulting from logging, fire, insect attacks, windthrow, restocking of cutovers and burns, growth, and transfer of land ownership since the original survey. Revised statistics, as of August 1, 1946, are given in this report and prints of the revised county type map may be obtained.[2/]

1/ Oregon and Washington were divided for survey purposes into two subregions: (1) Douglas-fir subregion, consisting of that part of both States west of the Cascade Range summit, and (2) ponderosa pine subregion, that part of both States east of the Cascade Range summit. A regional report, which includes an interpretation of the forest survey data and analysis of the forest situation, has been published for each of the two regions.

2/ For information on the detailed 1-inch-to-the-mile forest type map of the county or the 1/4-inch-to-the-mile lithographed State type maps covering Oregon and Washington, address Director, Pacific Northwest Forest and Range Experiment Station, 423 U. S. Court House, Portland 5, Oregon.

Forest Statistics for Klamath County, Oregon

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FOREST STATISTICS FOR KLAMATH COUNTY, OREGON

By F. L. Moravets

In the space of little longer than two decades the timber industries in Klamath County, Oregon, rapidly expanded, and contracted even more rapidly. Backed by what appeared to be limitless supplies of high-quality pine and stimulated by the construction of the Natron cut-off of the Southern Pacific Railroad, a number of large sawmills commenced operations during the 1920's. Interrupted only by the general business depression of the 1930's, lumber production increased, reaching a peak in 1941 with a production of over 800 million feet. Sawlogs cut during the year from timber in the county totaled 604 million feet--enough raw material to produce 83 percent of the lumber produced. Unusual efforts were made by public and private agencies during the war years to keep production at a high level. This chiefly consisted of making timber available to mills without firm supplies. At the end of the war emergency these efforts ceased and production dropped in the face of an active demand and favorable price situation. Two large operations closed down completely and others reduced their output. In 1945 lumber production in the county was only slightly more than half that of 1941.

It has long been evident that the forest resources could not permanently support the manufacturing capacity that developed in Klamath Falls. It is equally evident that further readjustments will take place before the industrial situation stabilizes.

This report, which presents the results of the reinventory of Klamath County, provides the basic information for an analysis of the capacity of the forest resource with relation to industrial demands. It gives basic data on forest types, areas, timber volumes, forest drain, and growth.

Physical Character of the County

Klamath County, with a land area of about 6,000 square miles, is one of the largest counties in Oregon. Located in the south-central portion of the State, it extends northward from the California line and eastward from the Cascade summit. The eastern three-quarters of the county is a part of the central Oregon high plateau and is relatively uniform in topography except for occasional buttes and high ridges. The western quarter, comprised of eastern slopes of the Cascade Range, is of rough, broken topography. The highest point in the county, Mt. Thielsen on the western boundary, is 9,178 feet in elevation. Elevations range downward to 4,100 feet. The western part of the county is characterized by numerous lakes, including Crater, Odell, Crescent, Upper Klamath, Davis, and Agency. Most of the county is drained by the Klamath River and tributaries in a southwesterly direction. The northern part of the county is drained to the north by tributaries of the Deschutes River.

Annual precipitation ranges from about 60 inches at the higher elevations in the Cascade Range to about 10 or 12 inches in the more arid eastern part of the county. The growing season is short and is less than 160 days in practically all parts of the county.

Nonforest Land

Approximately 915,000 acres, or 24 percent of the county, is classified as nonforest land in the 1946 resurvey (table 1). This is composed of cropland in the river valleys and reclaimed lake beds, range land, arid waste land, marsh land, and a relatively small area of mountain barrens.

Klamath is one of the leading agricultural counties in the State and has shown remarkable growth during the past few years. Value of farm products sold and used by farm households nearly tripled during the period 1939-44 according to the Agricultural Census, increasing from $4,962,329 in 1939 to $13,833,318 in 1944. Potatoes was the leading 1944 crop with a value of $7,946,184, followed by livestock with a 1944 value of $4,344,868.

Forest Land

Lands classified in the resurvey as forest l nd amount to 2,897,000 acres--76 percent of the county land area. These lands are further classified as commercial forest land or noncommercial forest land. Table 1 shows areas in each classification, by cover type.

Forest lands in the commercial category are those now bearing or capable of bearing a stand of timber of merchantal e character; those in the noncommercial category are either supporting stands of such poor character as to be unsuited for commodity use, now or potentially, or are rated as incapable of producing merchantable timber because of adverse growing conditions.

A total of approximately 2,691,000 acres, or 93 percent of the forest land, is placed in the commercial category; 207,000 acres, or 7 percent, is classed as noncommercial.

Commercial Forest Land

The commercial forest lands of the county fall quite readily into three generalized forest types, based on tree species occupying the land: First, ponderosa pine and sugar pine stands--those in which either of these species comprises 20 percent or more of the merchantable volume in the stand, and, in case of immature stands, 20 percent or more of the number of stems. Second, lodgepole pine stands--those in which lodgepole pine comprises 50 percent or more of the volume in saw-timber stands or number of stems in immature stands, and ponderosa pine or sugar pine does not comprise 20 percent of the volume or number of stems. And, third, upper-slope stands--those in which neither ponderosa pine, sugar pine, nor lodgepole pine is the key species, but which are of pure or mixed composition of such species as Douglas-fir, white fir, Shasta red fir, noble fir, alpine fir, mountain hemlock, western hemlock, western white pine, or Engelmann spruce.

Table 1.--Area of commercial and noncommercial forest land and nonforest land, by ownership and cover type, as of August 1, 1946

(Acres)

Survey type number	Cover type	Total	Unreserved									Reserved[1]			
			Total	Private	State	County	Indian	Federal				Total	State	Federal	
								Revested land grant	Public domain[2]	Grazing service	National forest			National park[3]	National forest
All lands															
	Forest land	2,897,275	2,644,015	800,625	22,845	6,100	791,110	45,745	58,160	47,360	872,070	253,260	150	136,160	116,950
	Nonforest land	915,485	894,585	523,325	3,655	1,390	187,180	310	60,165	46,870	71,690	20,900		16,875	4,025
	Total	3,812,760	3,538,600	1,323,950	26,500	7,490	978,290	46,055	118,325	94,230	943,760	274,160	150	153,035	120,975
Commercial forest land															
5½	Woodland, scattered ponderosa pine - 12" + d.b.h.	41,435	41,435	11,730	75	40	10,410	1,485	5,535	5,970	6,190				
	Ponderosa pine:														
20	Large, 50 to 80% pine - 22" + d.b.h.	93,160	91,200	14,620	65	185	28,840	3,045	180		44,265	1,960		1,615	345
20.5	Pure, large, 80% + pine - 22" + d.b.h.	758,305	750,745	183,830	795	390	358,055	2,595	2,740	4,780	197,560	7,560		5,680	1,880
20A	Ponderosa pine - sugar pine, large, 50% + ponderosa pine and 20% + sugar pine - 22" + d.b.h.	12,930	12,930	2,340			5,830	600			4,160				
21	Small, 12" to 20" d.b.h.	306,065	305,510	81,420	9,690	905	160,250	935	885	1,380	50,045	555	150	260	145
22	Seedlings and saplings, 50% + ponderosa pine - less than 12" d.b.h.	273,250	273,115	199,190	3,270	2,285	28,560	4,890	4,170	1,120	29,630	135		100	35
	Ponderosa pine mixture: 20 to 50% ponderosa pine														
27	Large - 12" + d.b.h.	67,770	65,950	28,720	2,220		7,610	5,785	205		21,410	1,820		1,495	325
28	Small - less than 12" d.b.h.	835	835	575			105				155				
20B	Sugar pine mixture: Large, 20% + sugar pine and less than 50% ponderosa pine - 22" + d.b.h.	17,130	17,105	6,030		190	1,460	2,695			6,730	25		25	
	Douglas-fir: 60% + Douglas-fir														
6	Large old growth - 42" + d.b.h.	5,600	5,600	520				595			4,485				
7	Small old growth - 22" to 40" d.b.h.	68,400	67,210	45,780				5,145			16,285	1,190		65	1,125
9A	Large poles - 12" to 20" d.b.h.	70	70	70											
9B	Small poles - 6" to 10" d.b.h.	145	145								145				
10	Seedlings and saplings - less than 6" d.b.h.	905	830					20			810	75		40	35
	Fir-mountain hemlock: 50% + of noble fir, Shasta red fir, alpine fir, or mountain hemlock														
23	Large - 12" + d.b.h.	223,245	118,545	4,505	235		270	5,975	215		107,345	104,700		44,730	59,970
24	Small - less than 12" d.b.h.	10,865	8,510	85				740	85		7,600	2,355		1,110	1,245
27½	Upper-slope mixture: Large, mixture of white fir, Douglas-fir, Engelmann spruce, lodgepole pine, or western white pine - 12" + d.b.h.	580	465								465	115			115
	White fir: 50% + of white fir														
29	Large - 12" + d.b.h.	21,865	18,210	8,005	1,575	70	2,420	1,560	15		4,565	3,655		2,410	1,245
30	Small - less than 12" d.b.h.	1,315	1,015	330	15	30					640	300		300	
	Lodgepole pine: 50% + lodgepole pine														
25	Large - 12" + d.b.h.	37,320	31,605	2,405	35		100		130		28,935	5,715		4,795	920
26	Medium - 6 to 10" d.b.h.	605,600	552,010	96,780	2,150	1,080	139,615	2,385	17,155		292,845	53,590		44,015	9,575
26A	Small - less than 6" d.b.h.	46,430	42,355	11,915	245		20,720		2,185		7,290	4,075		3,005	1,070
	Hardwoods: 50% + of hardwoods														
31.5	Large - 12" + d.b.h.	405	405	395							10				
31	Small - less than 12" d.b.h.	175	175	10			35				130				
35	Nonrestocked cutover: Logged area not stocked and with reserve stands less than 1 M per acre	37,180	37,165	31,170	355	270	445	2,205	1,360		1,360	15			15
37	Deforested area: Nonrestocked area deforested otherwise than by cutting	59,670	55,480	22,920	335	550	16,390	1,725	5,410	55	8,095	4,190		885	3,305
	Total	2,690,650	2,498,620	753,345	21,060	5,995	781,115	42,380	40,270	13,305	841,150	192,030	150	110,530	81,350
Noncommercial forest land															
4	Oak woodland: Scrub oak	605	605	210				365	30						
	Juniper woodland:														
5A	Dense juniper, 10% of area forested	26,745	26,745	6,355	505	40	255		3,620	13,515	2,455				
5B	Scattered juniper, 5 to 10% of area forested	79,350	79,345	36,785	1,280	40	2,515	450	11,120	20,490	6,665	5			5
33	Subalpine: Forest at upper limits of tree growth	82,285	24,225	50			5,800				18,375	58,060		24,485	33,575
38	Noncommercial rocky: Area below subalpine type too rocky or sterile to produce commercial forest	17,640	14,475	3,880		25	1,425	2,550	3,120	50	3,425	3,165		1,145	2,020
	Total	206,625	145,395	47,280	1,785	105	9,995	3,365	17,890	34,055	30,920	61,230		25,630	35,600

1/ Cutting for commodity production prohibited or limited by regulation or legislation.
2/ Includes 60 acres of type 20.5 and 20 acres of type 26 in railroad selection pending ownership.
3/ Includes 10 acres type 22 and 5,900 acres of nonforest land in wildlife refuge ownership.

As these three general forest types differ widely in economic importance, extent of utilization by the forest industries, and management pattern, each type will be discussed separately.

Pine Type. On the basis of preponderance, economic value, and utilization to date, the pine type is by far the most important in the county. It occupies 63 percent of the commercial forest land area, its key species--ponderosa pine--comprises 68 percent of the total merchantable timber volume, and it has contributed practically all of the volume of sawlogs that has been manufactured into lumber in the county in the 17-year period 1929-45. Although stands, in which sugar pine predominates, are included in this generalized category, this species is in majority composition on only 17,000 acres. Thus for all practical purposes, the "pine type," as here used, refers to ponderosa pine.

The pine type spreads broadly across the county, extending from the lower slopes of the Cascade Range on the west to the eastern boundary. In the northern third, broad areas of dry pumice soil occupied with pure lodgepole pine stands break up the expanse of the pine type. In this zone many of the ponderosa pine stands have a dense understory of pole-size lodgepole pine.

Of the total area of 1,666,000 acres of pine forest land, 1,297,000 acres is stocked with saw timber (stands containing more than 1,000 board feet per acre in trees 12 inches in diameter breast height and larger), 274,000 acres is stocked with immature stands less than saw-timber size, and 95,000 acres of pine site is currently in a deforested status.

Virgin Pine Saw Timber

Relatively few large unbroken tracts of virgin ponderosa pine saw timber remain. Logging operations have broken the original broad expanses of this timber type into a large number of isolated tracts. The extent and location of these tracts is seen in figure 1, which shows virgin saw timber in solid green color. In the northern third of the county all of these solid bodies represent ponderosa pine stands except those immediately adjacent to the county's western boundary; in the southern two-thirds, the virgin ponderosa pine stands lie along the eastern boundaries of Crater Lake National Park and Rogue River National Forest and extend eastward through the Klamath Indian Reservation and Fremont National Forest.

Pine saw-timber stands, in which there has been no cutting, total approximately 605,000 acres (table 2). This acreage is divided among seven Forest Survey saw-timber types. Five of these types can be classed as old-growth timber, in which the majority of the stand volume is in trees 22 inches d.b.h. and larger; one type is immature, in which the majority of the volume is in young, thrifty trees from 12 to 20 inches d.b.h.; and one of the types is characterized by sparsely stocked stands of rough quality timber, known as pine woodland. Brief descriptions of each of these seven types follow:

Table 2.--Area of commercial conifer forest land, by ownership and generalized forest type, as of August 1, 1946

(Acres)

Generalized forest type		Total	Unreserved									Reserved 1/			
			Total	Private	State	County	Indian	Federal				Total	State	Federal	
								Revested land grant	Public domain 2/	Grazing service	National forest			National park 3/	National forest
Ponderosa pine and sugar pine 12" or more d.b.h. Types 5½, 20.5, 20, 21, 27, 20A, and 20B.	Virgin	605,350	594,060	183,625	880	125	178,085	12,410	8,325	10,720	199,890	11,290		8,815	2,475
	Selectively cut	691,445	690,815	145,065	11,965	1,585	394,370	4,730	1,220	1,410	130,470	630	150	260	220
	Total	1,296,795	1,284,875	328,690	12,845	1,710	572,455	17,140	9,545	12,130	330,360	11,920	150	9,075	2,695
Ponderosa pine and sugar pine less than 12" d.b.h. Types 22 and 28.	On cutovers	265,010	265,010	197,680	3,270	2,195	25,490	4,880	3,930	705	26,860				
	On old burns	9,075	8,940	2,085		90	3,175	10	240	415	2,925	135		100	35
	Total	274,085	273,950	199,765	3,270	2,285	28,665	4,890	4,170	1,120	29,785	135		100	35
Conifers 12" or more d.b.h. other than ponderosa pine, sugar pine, and lodgepole pine. Types 6, 7, 9A, 14, 23, 27½, and 29.	Virgin	251,015	143,115	5,995	645		910	6,720	230		128,615	107,900		45,445	62,455
	Selectively cut	68,745	66,985	52,885	1,165	70	1,780	6,555			4,530	1,760		1,760	
	Total	319,760	210,100	58,880	1,810	70	2,690	13,275	230		133,145	109,660		47,205	62,455
Conifers less than 12" d.b.h. other than ponderosa pine, sugar pine, and lodgepole pine. Types 9B, 10, 24, and 30.	On cutovers	1,105	1,085	330		30					725	20		20	
	On old burns	12,125	9,415	85	15			760	85		8,470	2,710		1,430	1,280
	Total	13,230	10,500	415	15	30		760	85		9,195	2,730		1,450	1,280
Lodgepole pine 12" or more d.b.h. Type 25.	Virgin	37,280	31,565	2,405	35		100		130		28,895	5,715		4,795	920
	Selectively cut	40	40								40				
	Total	37,320	31,605	2,405	35		100		130		28,935	5,715		4,795	920
Lodgepole pine less than 12" d.b.h. Types 26 and 26A.	On cutovers	14,810	14,810	5,685	485	135	1,555	575	5		6,370				
	On old burns	637,220	579,555	103,010	1,910	945	158,780	1,810	19,335		293,765	57,665		47,020	10,645
	Total	652,030	594,365	108,695	2,395	1,080	160,335	2,385	19,340		300,135	57,665		47,020	10,645
Nonrestocked cutover, deforested burns, and areas deforested by insects. Types 35A, 35B, 35C, 37, and 37B.		96,850	92,645	54,090	690	820	16,835	3,930	6,770	55	9,455	4,205		885	3,320
TOTAL		2,690,070	2,498,040	752,940	21,060	5,995	781,080	42,380	40,270	13,305	841,010	192,030	150	110,530	81,350

1/ Cutting for commodity production prohibited or limited by regulation or legislation.
2/ Includes 60 acres of ponderosa pine 12 inches or more d.b.h. and 20 acres lodgepole pine less than 12 inches d.b.h. in railroad selection pending ownership.
3/ Includes 10 acres of ponderosa pine less than 12 inches d.b.h. in wildlife refuge ownership.

Pure ponderosa pine, type 20.5, in which this species comprises more than 80 percent of the stand volume, occupies four-fifths of the virgin pine saw-timber area, and contains nine-tenths of the merchantable pine volume. Remaining stands of this type average between 13,000 and 14,000 board feet per acre, of which 95 percent is ponderosa pine. The principal associate species is white fir; other species in minor occurrence are sugar pine, lodgepole pine, and incense cedar.

Stands in which ponderosa pine comprises 50 to 80 percent of the stand volume, type 20, cover 52,000 acres, or about 9 percent of the virgin pine acreage. In general, this type is found on better watered sites than type 20.5 and the stands are denser; the average volume is approximately 18 thousand board feet per acre. Ponderosa pine makes up two-thirds of the stand volume and white fir the major portion of the remainder. Other associates are sugar pine, Douglas-fir, and incense cedar.

The pine mixture stands, type 27, in which 20 to 50 percent of the volume is ponderosa pine, are found on 25,000 acres. This type occurs chiefly on cool, moist, north slopes in the pine zone and on the lower slopes of the Cascade Range. White fir and Douglas-fir are chief components of the mixtures; incense cedar is a minor associate in some mixtures. Average volume per acre of these mixed stands is about 13 thousand board feet.

Saw-timber stands containing appreciable amounts of sugar pine cover 22,000 acres. On two-fifths of this acreage, ponderosa pine comprises more than 50 percent of the stand and sugar pine the larger portion of the remainder, type 20A; on the other three-fifths of the acreage sugar pine is the major species and ponderosa pine is in minor amounts, type 20B. White fir and Douglas-fir are principal components of the mixture in the latter stands. Stands of these two types contain from 17 to 20 thousand board feet per acre on the average.

Immature stands of ponderosa pine, containing trees 12 to 20 inches d.b.h., are mapped as type 21. The 11,000 acres of this type includes several small tracts up to a few hundred acres in extent and a few of from 1,000 to 3,000 acres. These stands average about 5,000 board feet per acre.

Sparsely stocked stands of short-boled, limby ponderosa pine occur on dry sites along the lower fringe of the forests--a zone sometimes called the dry timber line. These stands are classed as pine woodland, type 5½. They occupy 41,000 acres, chiefly in the southern third of the county. Although the timber in this type is of inferior quality and low in volume--1,000 to 3,000 board feet per acre--it is generally of commercial character.

Selectively Cut Saw Timber

Stands from which a material part of the volume has been removed by logging, but which still have a merchantable volume of 1,000 board feet or more per acre, are classed as selectively cut saw timber. Logging in Klamath County to date has been confined almost entirely to virgin stands in which ponderosa pine was the major species. Different intensities of cut, arising from the management practices dictated by ownership policy, have resulted in the selectively cut stands having a wide variation of species composition, stand structure, and merchantable volume. On the Indian lands in the Klamath Indian Reservation, managed by the Indian Service, and on national forest lands in the county, managed by the Forest Service, selective cutting of the pine stands has been the practice. On earlier operations on these public lands--up to about 10 years ago--generally 75 to 80 percent of the stand volume was removed in form of mature, overmature, and suppressed trees; in recent years the selection has generally been lighter, at times removing but about half of the stand volume. Prior to about 1942 the practice on nearly all private lands was to cut to a diameter limit--usually 16 or 18 inches d.b.h. Over large acreages such logging practically amounted to clear cutting as the reserve pine volume amounted to only a few hundred board feet per acre. In recent years, however, some of the private companies are logging their pine lands on a selection basis comparable to that practiced on Indian and national forest lands.

The resurvey in 1946 disclosed that a total of 1,063,000 acres, or 40 percent of the commercial conifer forest land in the county, had been logged. A summary of the present reserve-stand conditions on the cut-over land is given in table 3 by ownership class.

Table 3.--Reserve-stand conditions on pine cut-over land

Ownership class	Total area	Area occupied by			Area non-restocked
		Pine reserve stands of		Other reserve stands 1/	
		1 M bd. ft. or more per acre	less than 1 M bd. ft. per acre		
	Acres				
Private	426,800	145,065	197,680	52,885	31,170
Indian	422,085	394,370	25,490	1,780	445
National forest	165,365	130,840	26,860	6,290	1,375
Other public 2/	48,885	21,925	14,980	7,790	4,190
Total	1,063,135	692,200	265,010	68,745	37,180

1/ Less than 20 percent of reserve volume is ponderosa pine.
2/ Includes State, county, revested land grant, public domain, Grazing Service, and national park ownerships.

Seventy-one percent of the logged area has a reserve stand of 1,000 board feet or more per acre in trees 12 inches d.b.h. and larger--on 65 percent the stand is predominantly ponderosa pine, on 6 percent it is of species other than pine. On 25 percent of the area the reserve stand is less than 1,000 board feet, and on 4 percent there is no reserve stand and no seedlings, saplings, or pole-size trees--the area is less than 10 percent stocked.

The reserve stands on logged lands contain a total volume of all species of 3.3 billion board feet, table 4, of which ponderosa pine amounts to more than 2.4 billion feet. A large portion of the remainder is Douglas-fir and white fir. More than three-fourths of the pine reserve stands are of practically pure ponderosa pine. On areas logged by light selection the pine reserve varies from 6,000 to 9,000 board feet per acre; on areas where selection was fairly heavy, the reserve is from 2,000 to 5,000 board feet; and on the areas where logging was to a minimum diameter it is from 0 to 2,000 board feet, averaging about 1,500 board feet over large areas.

The pure pine reserve stands on heavily cut areas are composed of immature trees from 12 to 16 inches d.b.h. and old suppressed trees of similar diameters. On the lightly cut areas the bulk of the reserve volume is in thrifty mature trees from 22 to 30 inches d.b.h.

White fir is the principal associate species in the mixed pine reserve stands. Prior to about 1944 this species was utilized very little by the lumber industry in the county, and about the only cutting of it in logging operations was sanitation cutting on national forest and Indian timber sales, which required felling of defective and large-diameter trees. Operations on private lands felled no white fir. As a result, there is an appreciable acreage of reserve stands composed of varying amounts of white fir. Beginning in 1944 several of the sawmills in the county began utilizing a considerable volume of white fir logs with the result that the species is now cut along with the pine on current operations and in relogging operations on previously logged areas.

In the southwest portion of the county there is a total of 53,000 acres of reserve stands in which Douglas-fir is the chief component and white fir and incense cedar are minor associates. Approximately a third to a half of the original stand was ponderosa pine, but practically all of this was cut. As there is very little pine reproduction in the understory of these stands, their identity as pine stands was lost through logging.

Ponderosa Pine Reproduction Stands

Ponderosa pine reproduction includes all trees less than 11.0 inches d.b.h., i.e., poles, saplings, and seedlings. Pole-size trees are from 5.0 to 10.9 inches d.b.h.

Table 4.--Volume of timber by ownership and species, as of August 1, 1946
(Thousand board feet, log scale, Scribner rule)

Species	Total	Unreserved									Reserved 1/			
		Total	Private	State	County	Indian	Federal				Total	State	Federal	
							Revested land grant	Public domain 2/	Grazing service	National forest			National park	National forest
All species														
Conifers: In virgin stands	10,563,316	9,390,020	2,560,126	9,240	794	2,277,012	236,819	30,702	34,452	4,240,875	1,173,296		604,487	568,809
In selectively cut stands	3,299,857	3,288,939	922,018	33,468	4,841	1,609,521	62,824	3,288	1,619	651,360	10,918	750	9,056	1,112
Total	13,863,173	12,678,959	3,482,144	42,708	5,635	3,886,533	299,643	33,990	36,071	4,892,235	1,184,214	750	613,543	569,921
Hardwoods (Golden aspen): In virgin stands	1,480	1,480	1,450							30				
Total: In virgin stands	10,564,796	9,391,500	2,561,576	9,240	794	2,277,012	236,819	30,702	34,452	4,240,905	1,173,296		604,487	568,809
In selectively cut stands	3,299,857	3,288,939	922,018	33,468	4,841	1,609,521	62,824	3,288	1,619	651,360	10,918	750	9,056	1,112
Total	13,864,653	12,680,439	3,483,594	42,708	5,635	3,886,533	299,643	33,990	36,071	4,892,265	1,184,214	750	613,543	569,921
Conifers (trees 12 inches d.b.h. and larger)														
Ponderosa pine: In virgin stands	6,948,313	6,778,771	2,125,674	8,556	747	2,125,819	82,322	23,572	34,452	2,377,629	169,542		128,869	40,673
In selectively cut stands	2,446,347	2,444,227	419,371	18,492	3,514	1,467,420	8,162	2,483	1,619	523,166	2,120	675	497	948
Total	9,394,660	9,222,998	2,545,045	27,048	4,261	3,593,239	90,484	26,055	36,071	2,900,795	171,662	675	129,366	41,621
Sugar pine: In virgin stands	212,421	211,801	76,352	13	20	55,655	21,804	35		57,922	620		437	183
In selectively cut stands	57,616	57,616	20,799	241	474	16,247	1,236			18,619				
Total	270,037	269,417	97,151	254	494	71,902	23,040	35		76,541	620		437	183
Western white pine: In virgin stands	167,793	126,063	4,192			3,592	4,655			113,624	41,730		6,629	35,101
In selectively cut stands	1,267	1,192	712				120			360	75	75		
Total	169,060	127,255	4,904			3,592	4,775			113,984	41,805	75	6,629	35,101
Lodgepole pine: In virgin stands	203,123	144,653	6,373	27		2,840	450	260		134,703	58,470		30,834	27,636
In selectively cut stands	34,574	34,502	8,839	335	84	10,438	440	7		14,359	72		72	
Total	237,697	179,155	15,212	362	84	13,278	890	267		149,062	58,542		30,906	27,636
Douglas-fir: In virgin stands	683,292	630,032	98,955			4,634	32,184	572		493,687	53,260		4,197	49,063
In selectively cut stands	371,759	371,735	303,369	96	155	21,445	26,302	242		20,126	24			24
Total	1,055,051	1,001,767	402,324	96	155	26,079	58,486	814		513,813	53,284		4,197	49,087
Western hemlock: In virgin stands	45,967	27,172								27,172	18,795		5,070	13,725
Mountain hemlock: In virgin stands	545,019	164,322		164		2,759				161,399	380,697		206,812	173,885
White fir: In virgin stands	722,352	673,080	191,640		27	79,956	34,840	966		365,651	49,272		22,380	26,892
In selectively cut stands	292,954	284,331	122,242	13,183	536	85,517	12,933	437		49,483	8,623		8,487	136
Total	1,015,306	957,411	313,882	13,183	563	165,473	47,773	1,403		415,134	57,895		30,867	27,028
Noble fir and Shasta red fir:														
In virgin stands	970,757	587,065	42,934	480		287	60,119	4,950		478,295	383,692		198,610	185,082
In selectively cut stands	37,890	37,890	6,615	660			9,680			20,935				
Total	1,008,647	624,955	49,549	1,140		287	69,799	4,950		499,230	383,692		198,610	185,082
Alpine fir: In virgin stands	10,407	7,006								7,006	3,401			3,401
California incense-cedar: In virgin stands	20,676	19,558	14,006			1,470	445	347		3,290	1,118		552	566
In selectively cut stands	57,137	57,133	39,763	461	78	8,454	3,951	119		4,307	4			4
Total	77,813	76,691	53,769	461	78	9,924	4,396	466		7,597	1,122		552	570
Engelmann spruce: In virgin stands	33,196	20,497								20,497	12,699		97	12,602
In selectively cut stands	313	313	308							5				
Total	33,509	20,810	308							20,502	12,699		97	12,602
Hardwoods (trees 12 inches d.b.h. and larger)														
Golden aspen: In virgin stands	1,480	1,480	1,450							30				

1/ Cutting for commodity production prohibited or limited by regulation or legislation.
2/ Includes 648 thousand board feet of ponderosa pine in virgin stands on land in railroad selection pending ownership.

Included in this category are the reproduction stands in the understory of the reserve saw-timber stands on selectively cut lands, those on cut-over lands where the reserve volume of saw timber is less than 1,000 board feet per acre, and those on areas on which the virgin overstory of saw timber was destroyed either by the western pine beetle or by fire. Table 5 shows the ponderosa pine reproduction stands by origin, degree of stocking, and ownership.

A recapitulation of the stocking classes in the table shows that 204,000 acres, or 21 percent of the total area of pine reproduction, is well stocked; 500,000 acres, or 52 percent, is of medium stocking; and 262,000 acres, or 27 percent is poorly stocked.

Deforested Pine Land

As seen in table 5 approximately 37,000 acres of pine cut-over land is nonrestocked. Lands in this classification do not have a reserve stand of saw timber of 1,000 board feet or more per acre, and are not stocked with reproduction of a density of 10 percent or more. This deforested condition has resulted from logging that removed practically all of the trees of saw-timber size and subsequent fires which killed all advance reproduction and have prevented reseeding.

Pine lands deforested by fire alone total 51,000 acres. This acreage is comprised of several separate areas, some of which were deforested by a single hot fire, others by recurring fires. On most of this acreage, natural reforestation is very improbable, due to either a dense ground cover of brush or lack of nearby seed supply, or both.

Lodgepole Pine Type. The lodgepole pine type covers a total of 689,000 acres, more than one-fourth of the commercial forest land area. Nearly all of this acreage is in the northern third of the county. Here, lodgepole pine and ponderosa pine occur in about equal proportions in a patchwork pattern that extends across the width of the county from a short distance below the summit of the Cascade Range on the west to the eastern boundary. In addition to the large areas of pure stands of lodgepole pine, the species also forms dense stands in the understory of much of the ponderosa pine type. Elsewhere in the county, lodgepole pine occurs in one large body of pure stands along the eastern boundary just north of Gearhart Mountain, and in several small bodies through the central portion of the Klamath Indian Reservation, in Crater Lake National Park, and southward from the Park along the summit of the Cascade Range.

Table 5.--Ponderosa pine reproduction stands by origin, stocking, and ownership

Ownership	Total all stands	On cut-over land						On areas deforested by western pine beetle or fire		
		Under reserve saw timber			Under little or no reserve saw timber					
		Degree of stocking 1/								
		≡	=	-	≡	=	-	≡	=	-
Private	344,780	22,215	81,200	41,600	25,270	100,635	71,775	725	640	720
Indian	423,085	111,155	187,775	95,490	2,725	11,215	11,550	305	2,315	555
National forest	161,040	33,280	80,460	17,480	3,195	14,175	9,490	790	1,315	855
Other public	37,380	3,175	11,875	6,495	1,190	8,055	5,735	35	615	205
Total	966,285	169,825	361,310	161,065	32,380	134,080	98,550	1,855	4,885	2,335

1/ ≡ indicates stocking density of 70 to 100 percent, = of 40 to 69 percent, and - of 10 to 39 percent.

In Klamath County lodgepole pine occupies dry, level pumice sites. Nearly all of the stands of this species are densely stocked. Although the stands appear to be even-aged over large areas, closer observation and age determinations disclose the broad expanses of the type to consist of a large number of different age classes, each class occupying a relatively small acreage. This broken pattern of age classes apparently results chiefly from intermittent infestations of the mountain pine beetle, which occur from time to time and kill the stand on areas of varying extent. Restocking of the beetle-killed areas follows and a new age class is established. Fire is another cause of this pattern of age classes.

In the survey, three size classes of lodgepole pine were recognized, table 1: Large or saw-timber stands, type 25, in which the majority of the trees are of saw-timber size (11.0 inches d.b.h. and larger); medium or pole timber stands, type 26, in which the majority of the trees are in the 6-to-10-inch diameter classes (5.0 to 10.9 inches d.b.h.); and small or seedling and sapling stands, type 26A, in which the majority of the trees are less than the 6-inch diameter class (0.1 to 4.9 inches d.b.h.).

Lodgepole pine saw-timber stands cover only 37,000 acres. This acreage is comprised of a number of individual bodies from 100 to 3,000 acres in extent. Board-foot volume in trees of saw-timber size in these stands varies from 2,000 to 5,000 feet. In addition, there is an understory of pole-size trees, some of which meet specifications for telephone or power poles.

The medium- or pole-size stands cover approximately 606,000 acres, or 88 percent of the total area of lodgepole pine type in the county. Some of these stands contain occasional trees of saw-timber size, and nearly all of them have suppressed trees of less than the 6-inch diameter class, but the majority of the trees average between 8 or 9 inches d.b.h. Dense stands over fairly large areas contain 250 or more trees per acre; light stands may have only 25 to 50 trees, but the average stand contains about 100 trees.

The denser stands contain straight, clear-boled trees of good height, many of which are suited for telephone or power poles. In the lighter stands the trees are generally short and limby, poorly suited for poles. A brief sampling study, made during the resurvey, in some of the better stands in the county showed an average stand of 143 trees in the 5-inch diameter class and larger per acre. Twenty trees were of saw-timber size and varied from 11 to 24 inches d.b.h.; 123 trees were of pole size, 5.0 to 10.9 inches d.b.h. Conservative classification of the trees, according to the American Standards Association dimensions for lodgepole pine power poles, showed an average of 25 trees per acre suitable for power poles.

The seedling and sapling lodgepole pine stands are found on about 46,000 acres. Included in this acreage are a considerable number of tracts of a few hundred acres each and a few tracts of 2,000 to 3,000 acres. Generally these young stands are densely stocked with trees of the same age class. Occasional stands contain scattered pole-size or saw-timber trees which escaped the beetle infestation or fire which killed the previous stand.

There has been very little cutting in the lodgepole pine stands to date. Beginning in the fall of 1945 a demand for power poles for the Rural Electrification Administration program resulted in selective logging of poles, from pure lodgepole pine stands and from the understory of ponderosa pine stands, on a relatively small acreage. There has also been some selective logging of lodgepole pine stands for sawlogs for small portable sawmills. Logging operations in ponderosa pine stands, in which there was a dense understory stand of lodgepole pine, have removed all of the ponderosa pine overstory from approximately 15,000 acres in the northern part of the county. As there was little or no ponderosa pine reproduction in these stands, clear cutting of the overstory has changed the ponderosa pine type to a lodgepole pine type.

Upper-Slope Type. The third generalized forest type in the county, the upper-slope type, covers a narrow zone of mountainous terrain along the county's western boundary. This zone reaches from about the 5,500-foot level to the summit of the Cascade Range, and extends southward from the county's northern boundary almost to the southern boundary of the Rogue River National Forest. The type covers much of Crater Lake National Park. Throughout the zone the continuity of the type is broken by broad areas of pure lodgepole pine type and the subalpine timber type.

Most of the stands of the upper-slope type are composed of various mixtures of mountain hemlock, noble fir, Shasta red fir, white fir, and lodgepole pine. In addition, each of these species forms pure stands over fairly large areas. Douglas-fir is found frequently in the mixture, as is western white pine. Douglas-fir also forms pure stands over limited acreages. Higher on the slopes, above 7,000 feet or more, Engelmann spruce, whitebark pine, and alpine fir are part of the mixed stands; the spruce is more common in the northern part of the zone.

Upper-Slope Saw Timber

The resurvey classified approximately 320,000 acres of the upper-slope zone as saw timber. This acreage is comprised of several detailed survey types. Seventy percent of the acreage is type 23, balsam fir-mountain hemlock saw timber, and includes various mixtures of mountain hemlock, noble fir, Shasta red fir, and alpine fir, and also, pure stands of these species. Twenty-one

percent is type 7, small old-growth Douglas-fir, and 7 percent is type 29, white fir. The remaining 2 percent is chiefly type 6, large old-growth Douglas-fir; there are small areas each of type 27½ and type 9A.

The only logging in the upper-slope type at time of the re-survey had been on the Rogue River National Forest where Shasta red fir has been cut on a small timber sale.

Selective logging of pine mixture stands in the southwest portion of the southwest portion of the county left approximately 69,000 acres of reserve stands that are classified as one of the upper-slope types. Logging removed practically all of the ponderosa pine saw timber from the mixed stands, and the advance reproduction contains practically no young pine.

The timber in the upper-slope zone varies considerably in quality. On the lower slopes the stands are fairly dense and the trees are of average height and clear length, but many of the stands are overmature and defect is fairly high. Some stands of mountain hemlock, in the northern part of the zone, contain a gross volume of 30,000 board feet per acre, but cull is estimated to be high. Stands of Shasta red fir in parts of Crater Lake National Park and southward contain a fairly high volume per acre--15,000 to 30,000 board feet per acre--but many of them are overmature. Douglas-fir is usually of fair quality, the principal defect being butt rot. Western white pine, along the summit in the lower part of the Rogue River National Forest, is of fine quality, the only defect being butt rot which extends a few feet up the bole above stump height.

The best lodgepole pine in the county occurs in mixed stands in the upper-slope zone. Here, this species attains good height and straight, clear boles with a breast-height diameter from 12 to 18 inches. However, there are only a few trees per acre.

On higher elevations of the zone the stands of all upper-slope species are sparse and trees are short and limby. Defect is also high and net volumes per acre average from 2,000 to 5,000 board feet. The principal value of these stands at present is for watershed protection.

Upper-Slope Reproduction Stands

Reproduction stands of the upper-slope species are small in extent, covering but 13,000 acres. Ninety-one percent of this acreage is restocked burns and 9 percent is cut-over land. Eighty-two percent of the total reproduction acreage is type 24, balsam fir-mountain hemlock mixture.

In addition to the area classified as young upper-slope type, white fir commonly and Douglas-fir occasionally are important associates of ponderosa pine in reproduction stands under pine reserve stands on selectively logged land.

Deforested Upper-Slope Land

Approximately 9,000 acres in the upper-slope zone, originally forested with commercial timber, is now in a deforested condition due to fire. There are a few areas of 1,000 to 2,000 acres and several from 50 to 200 acres in extent. Natural restocking of these burns will be very slow, due to a dense brush cover that has come in following the burn.

Productive Capacity of Commercial Forest Land. A phase of the original inventory of the forests of Klamath County in 1934 was a classification of all of the commercial forest land according to site quality, or the relative capacity of the land to produce forest stands of commercial character. Some revision of this classification was made in the inventory. The revised classification is presented in table 6.

The 2,691,000 acres of commercial forest land in the county is divided into three categories, on basis of species occupying the land: First, ponderosa pine site, which includes all lands occupied by ponderosa pine, sugar pine, or white fir stands; second, Douglas-fir site, lands occupied by the detailed Douglas-fir types, balsam fir-mountain hemlock types, and upper-slope mixture type; and third, lodgepole pine site, lands occupied by any of the three lodgepole pine types. Deforested lands are classified according to the original stand.

In general, the minimum site-class area recognized is 640 acres, although unusual site areas as small as 160 acres are segregated.

Ponderosa Pine Site

As seen in table 6 a total of about 1,689,000 acres, or 63 percent of the commercial forest land area, is classed as ponderosa pine site. Rating of this land is by a site classification developed for ponderosa pine but found applicable also to the two common associate species, sugar pine and white fir. Six site classes are recognized in this classification; class I is the most productive, class VI the least.

No site class I areas large enough to segregate are found; class II areas total an insignificant area; but class III, a site of good productivity, is found on about 14 percent of the pine acreage. Nearly 76 percent of the pine acreage is rated class IV, the common pine site class in eastern Oregon. About 10 percent of the acreage is rated class V and less than 0.1 percent is rated class VI.

In general, site classes II and III include the better-watered north and east slopes, site IV the broad plateau lands, and site V the dry south and west slopes and woodland fringe near the dry timber line.

Table 6.--Area of unreserved and reserved commercial conifer forest land by site quality class 1/, as of August 1, 1946

Kind of forest land and site quality class	Total		Unreserved		Reserved 2/	
	Acres	Percent	Acres	Percent	Acres	Percent
All sites						
Ponderosa pine	1,688,785	62.8	1,670,695	66.9	18,090	9.4
Douglas-fir	311,935	11.6	201,375	8.1	110,560	57.6
Lodgepole pine	689,350	25.6	625,970	25.0	63,380	33.0
Total	2,690,070	100.0	2,498,040	100.0	192,030	100.0
Ponderosa pine site						
Site class II	4,905	0.3	3,985	0.2	920	5.1
Site class III	242,010	14.3	235,920	14.1	6,090	33.7
Site class IV	1,275,410	75.5	1,266,130	75.8	9,280	51.3
Site class V	164,970	9.8	163,170	9.8	1,800	9.9
Site class VI	1,490	0.1	1,490	0.1		
Total	1,688,785	100.0	1,670,695	100.0	18,090	100.0
Douglas-fir site						
Site class III	36,755	11.8	36,755	18.3		
Site class IV	112,515	36.1	66,550	33.0	45,965	41.6
Site class V	162,665	52.1	98,070	48.7	64,595	58.4
Total	311,935	100.0	201,375	100.0	110,560	100.0
Lodgepole pine site						
Total	689,350	100.0	625,970	100.0	63,380	100.0

1/ The "site quality" of a forest area is its relative productive capacity, determined by climatic, soil, topographic, and other factors. The index of site quality is the average height of the dominant stand at the age of 100 years. Six site quality classes are recognized in the ponderosa pine classification and five in the Douglas-fir classification, class I being the highest. In the survey, the ponderosa pine classification was used for ponderosa pine, ponderosa pine mixture, sugar pine mixture, and white fir types; the Douglas-fir classification was used for Douglas-fir, fir-mountain hemlock, and upper-slope mixture types. No site classification is available for lodgepole pine stands.

2/ Cutting for commodity production prohibited or limited by regulation or legislation.

Douglas-fir Site

Nearly 312,000 acres is rated by a Douglas-fir site classification which recognizes five classes, class I the most productive, class V the least.

As shown by the table, more than half of the land rated by this classification is class V. Included in this class are the higher slopes and ridges near and along the summit of the Cascade Range where soil is thin and sterile, growing season short, and exposure severe. The class IV areas, 36 percent of total area, is productive of short timber of fair quality; the class III, about 12 percent of total area, produces timber of average quality.

Lodgepole Pine Site

No site classification has been developed for lodgepole pine in this region. Over the 689,000 acres of the county occupied by stands of this species, it is readily apparent that productive capacity varies considerably between areas. Here, the species attains its best development fairly high on the upper slopes near the summit of the Cascade Range, and on lower slopes and flats near stream courses. Relatively good development is attained by the understory stands of lodgepole pine in the ponderosa pine type. Dry, pumice flats comprise the bulk of the area of lodgepole pine type and these are low in productivity.

Timber Volume

Total merchantable volume of timber in trees of 12-inch diameter class and larger is 13,864.7 million board feet. Volume of the 13 conifer species is 13,863.2 million feet; of the one hardwood species--golden aspen--it is 1.5 million feet. Table 4 presents the timber volume by ownership and species. As seen in the table which segregates the volume in virgin stands from that in selectively cut stands, 10,564.8 million feet, or 76 percent, is in virgin stands and 3,299.9 million feet, or 24 percent, is reserve volume in selectively cut stands.

The volume of ponderosa pine, totaling 9,394.7 million feet, is slightly more than two-thirds of the volume of all species. Seventy-four percent of the volume of this species is in virgin stands and 26 percent in reserve stands on selectively cut areas. Other important species, on basis of volume, are Douglas-fir and white fir, each of which totals slightly more than 1 billion feet. Noble fir and Shasta red fir, combined, total nearly 1 billion feet.

Noncommercial Forest Land

Included in the category of noncommercial are forest lands stocked with trees of such poor form or quality as to make them unmerchantable for commodity production. The total of approximately 207,000 acres so classed includes oak woodland, juniper woodland, subalpine timber, and noncommercial rocky areas (table 1).

The oak woodland is found on a very small acreage on the dry, steep slopes of the canyon of Klamath River in the extreme southwestern portion of the county. The trees, Oregon white oak, are almost shrub like--short, limby, and of small diameter. Their only value is as sparse cover of the slopes, preventing erosion to some extent.

The juniper woodland, amounting to about 106,000 acres, supports sparse stands of short, limby trees of Sierra juniper. About a fourth of this acreage has trees covering 10 percent or more of the ground space; on the other three-fourths the trees cover from 5 to 10 percent of the ground space. A small number of fence posts is cut annually from some of the larger and better-formed junipers in this woodland type, but this use is not sufficient to classify the timber as commercial.

Subalpine forests, near the upper limits of tree growth, cover about 82,000 acres. Nearly all of these forests, consisting of short, very limby trees frequently in group or park-like occurrence, are found along the summit of the Cascade Range, on the slopes and ridges above the 6,000- to 7,000-foot levels. A small subalpine area lies on the western slopes of Yamsay Mountain, on the county's eastern boundary. These forests usually contain alpine fir, Engelmann spruce, whitebark pine, and occasionally mountain hemlock, noble fir, and Shasta red fir. They are of value chiefly for watershed protection and are also an important component of the scenery of the high slopes and ridges.

Most of the noncommercial rocky area, totaling about 18,000 acres, is on the slopes of the canyon of Klamath River. Here, rocky, sterile sites produce a short, rough growth of ponderosa pine and incense cedar. The trees are not of sawlog quality and too rough and inaccessible for utilization as fuel wood or fence posts.

Forest Ownership

Forest-area and timber-volume statistics, resulting from the reinventory of the forests of Klamath County, have been computed by ownership class. This segregation is shown in the statistical tables 1, 2, and 4, by each of the nine recognized ownership classes; in tables 5, 7, and 8 the statistics have been shown by four classes--private, Indian, national forest, and other public. Another segregation of the statistics shown in tables 1 to 4, inclusive, and 6 to 9, inclusive, is that of reserved and unreserved.

The reserved category includes all lands, and the timber thereon, that have been dedicated or set aside, by regulation or legislation, as recreational playgrounds, scenic areas, and museum areas. The reservation prohibits or limits the cutting of timber for commodity production. In this county the reserved areas include Crater Lake National Park, federal wildlife refuge on the west side of Upper Klamath Lake, Gearhart Mountain Wild Area and Goodlow Mountain Natural Area in the Fremont National Forest, Mountain Lakes Wild Area in the Rogue River National Forest, and a small park area owned by the State of Oregon.

The unreserved category includes all forest ownerships from which timber can be cut for commodity production. The individual unreserved ownership classes are:

Private - all forest land owned by individuals, companies, or corporations.

State - forest lands owned by the State of Oregon.

County - forest land deeded to Klamath County.

Indian - tribal forest lands owned by the Klamath Indians in the Klamath Indian Reservation and managed by the Indian Service, U. S. Department of Interior. These lands should not be considered in public ownership.

Revested land grant - federally owned lands originally granted to the Oregon and California Railroad and later revested in the Federal Government. The lands are now managed by the Bureau of Land Management, U. S. Department of Interior.

Public domain - unappropriated federal lands managed by the Bureau of Land Management, U. S. Department of Interior.

Grazing Service - federal lands managed, for grazing resources, at time of resurvey under the Taylor Grazing Act by Grazing Service, U. S. Department of Interior.

National forest - federal lands inside the Deschutes, Fremont, and Rogue River National Forests, managed by the Forest Service, U. S. Department of Agriculture.

Study of the statistical tables will provide the detail on forest ownership. However, tables 7 and 8 are presented as a quick analysis of the more important items of forest-land and timber-volume ownership. These items are shown, in percent of total area or volume, by the categories reserved and unreserved, and also by four ownership classes--private, Indian, national forest, and other public.

Table 7.--Ownership of all land, forest land, commercial forest land, and noncommercial forest land, in percent of total

Ownership	All land	Forest land	Commercial forest land	Noncommercial forest land
	Percent	Percent	Percent	Percent
Reserved	7	9	7	30
Unreserved	93	91	93	70
Total	100	100	100	100
Unreserved:				
Private	37	30	30	33
Indian	28	30	31	7
National forest	27	33	34	21
Other public	8	7	5	39
Total	100	100	100	100

Table 8.--Ownership of timber volume, of all species, and of ponderosa pine, in virgin stands and in reserve 1/ stands, in percent of total

Ownership	All species			Ponderosa pine		
	Total	In virgin stands	In reserve stands 1/	Total	In virgin stands	In reserve stands 1/
	Percent	Percent	Percent	Percent	Percent	Percent
Reserved	9	11	0.3	2	2	0.1
Unreserved	91	89	99.7	98	98	99.9
Total	100	100	100	100	100	100
Unreserved:						
Private	27	28	28	28	31	17
Indian	31	24	49	39	32	60
National forest	39	45	20	31	35	22
Other public	3	3	3	2	2	1
Total	100	100	100	100	100	100

1/ Stands left on selectively logged areas.

Forest Growth

Current Annual Net Growth

A phase of the resurvey of the forests of Klamath County is the calculation of the rate at which the forest inventory is being replenished by growth in the present stands on commercial forest land. This rate, known as current annual net growth, is computed separately for ponderosa pine and for all other species as a group. It is also computed separately for stands in unreserved ownership and for those in reserved ownership.

The forest growing stock on commercial forest land is divided into three stand classes: Virgin stands, reserve stands on selectively logged areas, and immature stands. The virgin class is saw-timber stands more than 160 years of age in which there has been no logging. The reserve stands on selectively logged areas are those which contain a merchantable volume of more than 1,000 board feet per acre in reserve trees. Immature stands are less than 160 years of age and include reproduction stands on logged areas where the reserve volume is less than 1,000 board feet per acre. The virgin stands total 596,000 acres, the reserve stands 690,000 acres, and the immature stands 295,000 acres--a grand total of 1,581,000 acres.

Current annual net growth is calculated in board feet, log scale, Scribner rule, for trees 11.0 inches d.b.h. and larger. Results of the calculations are given in table 9.

Table 9.--Estimated current annual net growth in trees 11.0 inches d.b.h. and larger, in reserved and unreserved ownership, by stand class

Thousand board feet, log scale, Scribner rule

Stand	Total			Unreserved ownership			Reserved ownership		
	Total	Ponderosa pine	Other species	Total	Ponderosa pine	Other species	Total	Ponderosa pine	Other species
Virgin	28,583	26,044	2,539	26,652	24,897	1,755	1,931	1,147	784
Reserve 1/	57,402	47,616	9,786	57,356	47,580	9,776	46	36	10
Immature	8,116	4,079	4,037	7,663	4,077	3,586	453	2	451
Total	94,101	77,739	16,362	91,671	76,554	15,117	2,430	1,185	1,245

1/ Stands left on selectively logged areas.

Potential Annual Net Growth

A second type of growth calculation was made following the resurvey. This was the calculation of the annual growth rate that might reasonably be expected at some time in the future, if all of the commercial forest land were under effective management. In determining this potential annual net growth rate, satisfactory stocking of all lands is presupposed, as is proportionate representation of all age classes up to rotation age.

The potential annual net growth in trees 11.0 inches d.b.h. and larger on unreserved commercial forest land is calculated at 269.9 million board feet--224.0 million feet on ponderosa pine sites and 45.6 million board feet on other sites.

In comparison, the current annual net growth rate on unreserved commercial forest land--91.7 million board feet--is slightly more than one-third (34 percent) of the potential rate.

Forest Depletion

Causes of drain on a forest inventory may be placed in two categories: One, drain that results from cutting in the production of sawlogs, poles, fence posts, fuel wood, and other forest products, and which may be termed commodity drain; and two, drain that results from natural causes such as fire, forest insects, forest diseases, and felling or breakage of trees by wind, and which is termed noncommodity drain.

Commodity Drain

In Klamath County, the rate of commodity drain has been high and fairly constant for the past two decades. Lumbering operations, becoming large scale along about the middle of the 1920's, removed almost 10 billion board feet of sawlogs from the county's forests during the 21-year period 1925-45.

Statistics on the volume of sawlogs produced in the county during this period, collected by the Forest Service, are shown in table 10, for specified periods:

Table 10.--Average annual production of sawlogs 1925-45, by specified periods

Volume in thousand board feet, log scale

Period	All species	Ponderosa pine
1925-29	418,910	404,578
1930-34	305,525	293,241
1935-39	537,200	504,827
1940-44	589,048	536,113
1945 (1 year)	446,509	383,958
Total volume	9,756,928	9,077,752
Average annual volume	464,616	432,273

Average annual volume of sawlogs produced during the period was 464.6 million board feet. Peak year was 1942 with 691.8 million feet; low year was 1932 with 183.7 million feet. That cutting drain is gradually decreasing as the private- and Indian-owned ponderosa pine timber is nearing the end of the first cutting cycle is clearly evidenced by production statistics for the five years 1941 to 1945--a period of very great demand for sawlogs by the lumber industry. In 1941 production was 604.1 million feet; in 1942, 691.8 million; in 1943, 512.5 million; in 1944, 503 million; and in 1945, 446.5 million.

Cutting drain, other than in form of sawlogs, is relatively insignificant in the county. Fuel wood cut from trees of saw-timber size is estimated at approximately 9 million board feet annually. A small number of fence posts are split from saw-timber trees but the bulk of the posts are in round form and cut from pole timber. Total drain from saw-timber trees in form of minor products is roughly 10 million board feet annually.

Noncommodity Drain

The extent of noncommodity drain, caused by natural agencies, is more difficult to measure than drain due to cutting. In Klamath County the principal cause of noncommodity drain has been forest insects. Specifically, the western pine beetle (Dendroctonus brevicomis) has been very destructive of ponderosa pine timber at intervals in the past, and the mountain pine beetle (D. monticolae) has killed relatively small volumes of both virgin and immature ponderosa pine and a considerable volume of lodgepole pine.

Entomologists are of the opinion the western pine beetle has always been present in the pine stands of eastern Oregon, but fortunately activities of this beetle have reached epidemic proportions only in three occasions since 1911, the year that records of infestations in the State began to be available. Peaks of the epidemics were reached in 1917, 1927, and 1932. Following each peak there was a period of declining activity resulting from action of natural factors of beetle control, such as low winter temperatures which killed the beetles and wet cycles which resulted in increased resistance of the pine stands. However, this fluctuation of beetle activity increases the difficulty of estimating drain rates. Since 1921 the Bureau of Entomology and Plant Quarantine has kept a continuous check of beetle losses on a series of sample plots in Klamath County and adjoining Lake County, and since 1931 has made annual surveys in cooperation with the Forest Service, Office of Indian Affairs, and private timber owners and agencies. From these records and surveys the trend of beetle damage can be traced. Loss was particularly high during the last epidemic which began in 1931 and reached the peak a year later. With the exception of 1938 and 1939, loss since 1932 has been relatively light. During the decade 1935-44 the annual volume of pine killed by beetles has averaged about 65 million board feet in Klamath County.

Another noncommodity drain that occurs annually is loss of timber felled or broken by wind. No catastrophic losses have occurred in recent years, but the normal annual windthrow loss is estimated to be about 0.1 percent of the merchantable saw-timber volume. Thus, in this county it would approximate 14 million board feet.

Fire has caused relatively little loss of timber volume in recent years. During the 5-year period 1941-45, fire records indicate the saw-timber volume killed and not salvaged would total about 0.1 million board feet annually.

A summary of total average annual drain on saw-timber stands in the county during the 5-year period, 1941-45, would include the following items:

	Million bd. ft., log scale
Sawlog cutting drain	551.6
Minor products cutting drain	10.0
Beetle-killed timber	65.0
Windthrown timber	14.0
Fire-killed timber	0.1
Total	640.7

Forest Industry

The lumbering industry in Klamath County dates from about 1863 when the United States Army set up the county's first sawmill near Fort Klamath to cut lumber for the Klamath Indians. During the next four decades, a considerable number of private sawmills were built in the Keno, Linkville (later named Klamath Falls), and Bonanza districts. These early mills were sash mills, or up-and-down, and were water driven. The first decade following 1900 saw a number of small circular sawmills, powered by steam, operated in the vicinity of Keno and Klamath Falls; the second decade saw several fairly large-capacity band and circular mills built north of Klamath Falls on Upper Klamath Lake, and near Chiloquin in the Indian Reservation. Construction of larger mills continued during the early 1920's, by which time annual production of lumber is estimated to have been between 200 and 250 million board feet. The big impetus came, however, in 1926 with development of better rail outlets. That year the Natron cutoff over the Cascade Range in the northwestern part of the county was completed and made the main line of the Southern Pacific Railroad. Later the Great Northern Railroad extended its line south from Bend, Oregon, to Chemult in the northern part of the county. Next came completion of the Alturas cutoff in 1929, which gave the Southern Pacific a connection at Reno, Nevada, with its main east-and-west line.

Completion in 1929 of the Weyerhaeuser Timber Company's large, modern mill near Klamath Falls, with its four double-cutting band headrigs and a gang saw, greatly increased the total sawmill capacity in the county.

Some idea of the great size and also trend of production, of the county's lumber industry can be obtained from table 11, which shows statistics, collected by the Bureau of Census in cooperation with the Forest Service, on the number of active sawmills and volume of lumber produced, by year, during the period 1925-45.

Table 11.--Lumber production and number of active sawmills in Klamath County, 1925-45, by years

Year	Number of active sawmills	Volume in thousand board feet
1925	20	391,397
1926	25	438,602
1927	22	378,575
1928	20	485,117
1929	19	507,469
1930	21	452,061
1931	14	369,365
1932	13	199,527
1933	20	305,449
1934	24	323,646
1935	23	459,617
1936	26	626,396
1937	23	680,590
1938	22	547,714
1939	24	698,395
1940	21	726,295
1941	22	808,631
1942	26	796,953
1943	20	692,978
1944	19	616,000
1945	17	420,922
Total volume		10,925,699
Average annual volume		520,271

During the 21-year period 92 percent of the total volume of lumber manufactured was ponderosa pine. Bulk of the remainder was Douglas-fir and sugar pine; beginning in 1942, the volume of white fir increased greatly.

Lumber manufacture has been the big forest industry of the county. Nearly all of the larger mills, however, have operated box factories in connection with lumber manufacture and the volume of box material produced has been great.

A number of remanufacturing plants have operated, their chief products being mouldings, sash and door stock, and frame stock.

Since 1938, a plant of an annual capacity of 24 million square feet of 3/8-inch, 3-ply plywood cut from ponderosa pine has operated in Klamath Falls.

In 1945 demand for power poles for the Rural Electrification Administration's program caused considerable interest in the production of poles from lodgepole pine in the northern part of the county. Several pole-logging operations in the latter part of 1945, and subsequently, have shipped poles to treating plants on the Columbia River near The Dalles, Oregon.

Forest Situation Analyzed

The recent downward trend of both log and lumber production in the county, at a time of great demand and high prices for lumber and other forest products, emphasizes the diminishing supply of available timber, particularly of the chief commercial species, ponderosa pine. The rate at which the timber supply has diminished in recent years is indicated by the following comparison of inventories--the original in 1934 and the reinventory in 1945.

Comparison of Inventories

Forest types and timber volume	1934	1945	Change in percent of 1934 value
Forest types (in thousands of acres)			
Virgin saw timber - all types, all ownerships	1,603	893	- 44
Virgin saw timber - all types, private ownership	524	192	- 63
Virgin saw timber - all types, Indian ownership	476	179	- 62
Virgin saw timber - all types, National forest ownership	486	423	- 13
Virgin saw timber - ponderosa pine types, all ownerships	1,309	605	- 54
Virgin saw timber - ponderosa pine types, private ownership	512	184	- 64
Virgin saw timber - ponderosa pine types, Indian ownership	474	178	- 62
Virgin saw timber - ponderosa pine types, national forest ownership	263	202	- 23
Saw-timber volume (million bd. ft., log scale)			
Total all species, all ownerships	22,437	13,865	- 38
Total all species, private ownership	7,700	3,484	- 55
Total all species, Indian ownership	7,673	3,887	- 49
Total all species, national forest ownership	5,931	5,462	- 8
Total ponderosa pine, all ownerships	17,040	9,395	- 45
Total ponderosa pine, private ownership	6,144	2,545	- 59
Total ponderosa pine, Indian ownership	7,132	3,593	- 50
Total ponderosa pine, national forest ownership	3,315	2,942	- 11

The comparison of 1934 and 1945 timber volumes do not tell the whole story as the volumes shown in the tabulation include both virgin and reserve-stand timber on selectively cut areas. Virgin timber volume alone constitutes practically all of the available timber supply for the next two to three decades. It is unlikely that very much of the reserve-stand timber will be cut until the second cutting cycle. The 1934 inventory did not segregate virgin timber volumes and reserve-stand volumes, but approximately 97 percent of the total volume then was virgin timber and 3 percent was reserve-stand timber. In 1945 about 76 percent was virgin and 24 percent was reserve stand. In the case of ponderosa pine, the 1934 virgin volume was approximately 16,500 million feet; in 1945 it was 6,948 million feet, a reduction of 58 percent.

Particularly significant is the large decrease in volume of private and Indian timber during the 11-year interval between inventories. The vast bulk of the sawlogs consumed by the lumber industry during the period came from timber in these two ownerships. Of the remaining virgin ponderosa pine saw-timber volume 31 percent is in private ownership, 31 percent is Indian owned, and 35 percent is on national forest land; the other 3 percent is largely on federally owned O and C and public domain lands.

Another measure of the timber supply in the county is a calculation of the volume that could be cut annually under a program of forest management that would assure a sustained yield of sawlogs for the lumber and allied industries. Such a measure is known as the allowable annual cut. On the basis of the present virgin timber volume and the estimated growth on the reserve stands and on the immature stands, the allowable average annual cut is calculated at 190 million board feet. This assumes that the virgin timber will be cut selectively and during the first cutting cycle, and that the reserve stands and immature stands will be cut in succeeding cycles in order of their ages. Subsequently, after the first rotation the forest lands should be able to support the estimated potential annual growth of approximately 270 million board feet.

On the basis of the above calculations it is apparent that the current volume of sawlog production in the county cannot be maintained under sustained-yield forest management. It is also apparent that the tapering off of the rate of cutting should be quite rapid in order to lengthen the first cutting cycle of virgin timber and thereby give the reserve stands and immature stands a longer growth period. From an industry standpoint maintenance of anywhere like the present volume of business, from a materially reduced volume of ponderosa pine sawlogs, will have to come through expansion of remanufacturing, utilization of waste, and greater utilization of species other than ponderosa pine.